

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

023600-227

U.S. APPLICATION NO. (If known, enter 35 U.S.C. 371)

Unassigned

09/581997

INTERNATIONAL APPLICATION NO.
PCT/FI98/01033

INTERNATIONAL FILING DATE
30 December 1998

PRIORITY DATE CLAIMED
31 December 1997

TITLE OF INVENTION
A VIBRATING AGGREGATE

APPLICANT(S) FOR DO/EO/US
Harri Lehtonen

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and the PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)) (executed Declaration will follow).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A FIRST preliminary amendment.
☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:

A copy of Finnish priority Application No. 974667, filed 31 December 1997 was duly filed in connection with International Application No. PCT/FI98/01033. Thus it is believed that the claim for priority has been perfected.

U.S. APPLICATION NO. 05/581997
UnassignedINTERNATIONAL APPLICATION NO.
PCT/FI98/01033ATTORNEY'S DOCKET NUMBER
023600-22717. ☒ The following fees are submitted:

CALCULATIONS

PTO USE ONLY

Basic National Fee (37 CFR 1.492(a)(1)-(5)):

Search Report has been prepared by the EPO or JPO \$840.00 (970)

International preliminary examination fee paid to USPTO (37 CFR 1.482) \$670.00 (956)

No international preliminary examination fee paid to USPTO (37 CFR 1.482)
but international search fee paid to USPTO (37 CFR 1.445(a)(2)) \$690.00 (958)Neither international preliminary examination fee (37 CFR 1.482) nor
international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$970.00 (960)International preliminary examination fee paid to USPTO (37 CFR 1.482)
and all claims satisfied provisions of PCT Article 33(2)-(4) \$96.00 (962)**ENTER APPROPRIATE BASIC FEE AMOUNT =**

\$ 970.00

Surcharge of \$130.00 (154) for furnishing the oath or declaration later than
months from the earliest claimed priority date (37 CFR 1.492(e)).20 ☐ 30 ☐

\$ --

Claims	Number Filed	Number Extra	Rate
Total Claims	12 -20 =	0	X\$18.00 (966)
Independent Claims	1 -3 =	0	X\$78.00 (964)

\$ --

\$ --

Multiple dependent claim(s) (if applicable)

+ \$260.00 (968)

\$ --

TOTAL OF ABOVE CALCULATIONS =

\$ 970.00

Reduction for 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be
filed. (Note 37 CFR 1.9, 1.27, 1.28).

\$ --

SUBTOTAL =

\$ 970.00

Processing fee of \$130.00 (156) for furnishing the English translation later than
months from the earliest claimed priority date (37 CFR 1.492(f)).20 ☐ 30 ☐

\$ --

TOTAL NATIONAL FEE =

\$ 970.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by
an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 (581) per property +

\$ --

TOTAL FEES ENCLOSED =

\$ 970.00

Amount to be:

refunded \$

charged \$

a. ☒ A check in the amount of \$ 970.00 to cover the above fees is enclosed.b. ☐ Please charge my Deposit Account No. 02-4800 in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-4800. A duplicate copy of this sheet is enclosed.**NOTE:** Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Benton S. Duffett, Jr.
BURNS, DOANE, SWECKER & MATHIS, L.L.P.
P.O. Box 1404
Alexandria, Virginia 22313-1404

SIGNATURE

Benton S. Duffett, Jr.

NAME

22,030

REGISTRATION NUMBER

Filed: June 21, 2000

Patent
Attorney's Docket No. 023600-227

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of) **Box PCT**
)
 Harri LEHTONEN) **Attn: DO/EO/US**
)
 Application No.: Unassigned) **Group Art Unit: Unassigned**
)
 Filed: June 21, 2000) **Examiner: Unassigned**
)
 For: A VIBRATING AGGREGATE)

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

This Application corresponds to International Application No. PCT/FI98/01033.

Please amend the above-identified Application as indicated.

In the Abstract:

Please add the Abstract of the Disclosure that is provided on a separate sheet.

In the Claims:

Claim 7, line 1, delete "any one of claims 1 to 6" and insert --claim 1--.

Please add the following new Claims 8 to 12:

--8. A vibrating aggregate as claimed in claim 2, characterized in that the joint
 (3) is locked by means of an axial screw (6).

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9. A vibrating aggregate as claimed in claim 3, characterized in that the joint (3) is locked by means of an axial screw (6).

10. A vibrating aggregate as claimed in claim 4, characterized in that the joint (3) is locked by means of an axial screw (6).

11. A vibrating aggregate as claimed in claim 5, characterized in that the joint (3) is locked by means of an axial screw (6).

12. A vibrating aggregate as claimed in claim 6, characterized in that the joint (3) is locked by means of an axial screw (6).--

REMARKS

The present Amendment is intended to eliminate the use of multiple dependency and adds an Abstract of the Disclosure.

The examination and allowance of the Application are respectfully requested.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By: Benton S. Duffett Jr.
Benton S. Duffett, Jr.
Registration No. 22,030

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Date: June 21, 2000

09581997, 092000

Abstract of the Disclosure

A vibrating aggregate for vibrating a piece attached thereto. The aggregate includes a shaft (1, 2), an eccentric mass connected thereto eccentrically and transmission arrangements for driving the shaft. A shaft section (2) located in both ends of the shaft and mounted by means of a bearing in the piece to be vibrated is detachably connected to the end of the connecting shaft (1) connecting the shaft sections by a joint (3) transmitting torque moment. The joint (3) between the shaft section (2) mounted by means of a bearing in the piece to be vibrated and the connecting shaft (1) is rigid and transmits therefore bending moment as well.

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A VIBRATING AGGREGATE

Technical Field

The invention concerns a vibrating aggregate according to the preamble of claim 1.

5 The invention relates to vibrating aggregates used in devices to be vibrated (typically in vibrating feeders and vibrating screens). A vibrating aggregate includes an eccentric mass whereby the screen basket or the feeder body connected to the aggregate and lying on springs begins to move by the influence exerted by the eccentric mass when the eccentric mass is rotated. When using one eccentric mass the movement of the screen or the feeder
10 has the form of a circular orbit. When using two rotating eccentric masses mechanically coupled to each other a linear impact motion is produced, its direction being changeable by changing the phase difference between the rotation of the eccentric masses. The length of the impact motion or stroke can be adjusted by adjusting the size of the eccentric masses.

15 Background Art

FR 2 668 960 discloses one well-known aggregate type. The aggregate shown in figure 1 thereof, representing the prior art, consists of a continuous connecting shaft driven by a pulley coupled thereto. Eccentric weights are coupled to the shaft by a cotter joint. The eccentric weights are provided with additional weights so as to increase the force of the vibration (i.e. the length of the stroke). The aggregate body and the bearing housings of the
20 bearings of the connecting shafts are fixed to the side plate of the screen basket/feeder body by a screw joint.

A aggregate like this is large and therefore cumbersome. Because screens/feeders often work in a dusty environment, the aggregate, when it is serviced or repaired (when a bearing
25 is changed, for example), has to be opened so that its oil chamber becomes exposed to dust and dirt. In vibratory use, the cleanliness of oil is even more crucial than usually as far as the service life of the bearings is concerned.

The same publication discloses an aggregate type developed to solve the problems with the earlier aggregate type. In the improved solution the connecting shaft is composed of
30 separate sections connected to each other. The sections of the shaft are connected to each

other by cotter or pin couplings (figures 2 and 7) or by articulated joints (figure 9) transmitting torque moment - but not bending moment. The joint between them is easy to dismount. The advantage of this technique is that the bearing combination at each end of the connecting shaft is separately detachable from the aggregate, together with the bearing housing and the oil chamber connected thereto. Consequently, the bearing arrangement can be serviced and repaired detached from the screen/feeder in a repair shop. Similarly, the spare parts service is easier because the change of parts does not take much time and the assembly of the aggregate part to be changed can be finished in workshop conditions to such an extent that the inconveniences caused by the difficult circumstances under the final mounting are controllable. Besides, the aggregate is easier to handle because it can be disassembled into smaller sections.

However, the aggregate presents a problem in that the technical realization of the bearing arrangement is more difficult. The connecting shaft being no longer rigid, both shaft ends have to be supported by two successive bearings, on both sides of the side plate, so that they can take the bending moment. Consequently, the bearings lie at a short distance from each other, which makes the aggregate very critical to the placement of the vibrating masses. Therefore, it has been necessary to divide the vibrating weight into equal parts accurately on both sides of the side plate to balance the force applied to the bearings. When it is desired to adjust the length of the impact motion or stroke of the screen/feeder, it is necessary to connect additional weights to both eccentric weights, or, at least to change the axial position of one weight as the mass of the other weight increases. If this is not done, the bearing arrangement is subjected to a bending moment which stresses the bearings unevenly so that they wear out earlier.

Because of the above, solving of the problems with the earlier aggregates in the way proposed in FR 2 668 960 has caused the aggregate structure to become radically more complicated and the production costs to increase.

Disclosure of Invention

A vibrating aggregate according to claim 1 has now been invented. In a vibrating aggregate according to the invention the joint between the shaft sections is rigid and without a clearance, and it transmits not only torque moment but also bending moment.

5 The advantage of the rigid shaft joint is that the aggregate can be mounted on the side plate of the screen basket/feeder body by means of one self-aligning bearing. In addition to the advantages of the earlier solutions (ease of disassembling and serviceable from outside of the screen basket/feeder body without having to open the oil chamber at the site, ease of handling), an aggregate according to the invention presents, for example, the following
10 advantages:

- Cost savings resulting from the simple structure (no complicated articulated shaft, less bearings).
- The same basic aggregate can be used for different kinds of vibrating devices because it is easy to adjust. Hence it can be manufactured in large series and at low production
15 costs.
- The bearings last long because the bearing loads are even and the misalignments of the shafts are insignificant.

Brief Description of Drawings

20 The invention and the details thereof will be described in the following text with reference to the enclosed drawings wherein

Figure 1 is a longitudinal section of an aggregate according to one embodiment of the invention,

Figure 2 is an enlarged view of the joint and the vibrating aggregate module used in the
25 aggregate of figure 1,

Figure 3 is a longitudinal section of an aggregate according to another embodiment seen from above,

Figures 4 - 7 show different joint alternatives seen from the side and from the end of the shaft.

Modes for Carrying Out the Invention

In a vibrating aggregate of a modular construction according to the invention, a connecting shaft 1 is connected to module shafts 2 by a joint without a clearance, transmitting both torque and bending moment. Preferably, this joint is a cone joint which in itself is known, for example, from machine tools as a way of connecting tools. A vibrating aggregate module shown in figure 2 forms an entity easily detachable from the device to be vibrated. The cone joint surface tapering towards that end of both module shafts which is connected to the connecting shaft is denoted by reference number 3. Both ends of the connecting shaft have corresponding cone-shaped recesses where the cone of the module shaft can be inserted. The cone angle of the cone joint has to be big enough so that it does not make the joint self-locking and difficult to dismount.

The aggregate is mounted on a side plate 4 of the screen basket/feeder body by one self-aligning spherical bearing 5. Both module shafts are fastened to the connecting shaft by an axial fixing screw 6 extending from the outer end of the module shaft to the connecting shaft through the cone. Furthermore, the cone is mounted to the connecting shaft by means of a pronged locking piece 15 or in another corresponding way of mounting so as to position the module shaft and the connecting shaft in the right position in relation to each other.

A bearing housing 10 functions as a module body and has a cover 11. A sealing ring 12 seals the cover against the module shaft. An oil chamber 13 is connected to the bearing and is sealed against the sealing locking piece 15 by a sealing 14. A sealing 14' is located between the cover 11 and the sealing ring 12. A protecting cover 16 fastened to the side plate 4 protects eccentric weights and a protecting tube 17 protects the connecting shaft.

The vibrating aggregate is driven by a suitable drive mechanism and transmission, for example by a V-belt drive. A pulley 18, located at the end of the other module shaft, is shown in the drawings.

The eccentric weights can be joined to the aggregate in different ways. The eccentric mass can be a separate eccentric weight 7 mounted on the module shaft so that the connecting shaft 1 does not have to be eccentric. The entire eccentric mass can also be placed on

the connecting shaft whereby the connecting shaft does not function only as a transmission shaft but also as an eccentric weight. Thus, the connecting shaft can, for example, be machined eccentric as shown in the drawings.

In the drawings a combination of the eccentric mass arrangements described above is shown, wherein the eccentric mass is placed not only on the connecting shaft 1 but also on the separate eccentric weights 7 fastened to the module shaft 2. Preferably, the centre axis of the connecting shaft is eccentric in the same direction as the eccentric weights 7 in relation to the module shafts. Thus, the connecting shaft and the eccentric weight compensate the misalignment of the module shaft, caused by the eccentricity of each other, at the bearing. This is of great importance as far as the warming-up and the service life of the bearing are concerned.

In addition, the aggregate is easier to adjust than aggregates having a connecting shaft connected by an articulated or flexible joint: additional weights 8, 9 can be joined to the module shaft in order to adjust the length of the impact motion or stroke of the device to be vibrated without stressing the bearing arrangement significantly because the bending moment caused by the additional weights to the module shaft 2 is transmitted to the connecting shaft 1 by means of the rigid shaft joint and the bending moment is not received by the bearing arrangement. Thus, no compensating weights need to be added on the shaft part between the bearings, and the aggregate can be adjusted by operating entirely outside the screen basket/feeder body.

Preferably, the extra weights 8, 9 are joined to the eccentric weights 7.

When using a cone joint between the connecting shaft and the module shafts, the advantage is obtained that in order to connect the shafts to each other one axial screw 6 reachable from the end of the aggregate is sufficient.

An aggregate according to the invention is, as shown in figure 3, can also be used for two-shaft use wherein two aggregates are coupled to each other by a gear transmission 19 in order to direct the impact motion of the aggregate to be vibrated.

The embodiments described above are to be considered not restrictive in character, the spirit and scope of the invention being limited solely by the appended claims. It is also pos-

sible to place the cone of the cone joint at the end of the connecting shaft. In that case the module shaft has a corresponding recess. Alternatives to the joint between the shaft sections are shown in figures 4 - 7. The cone joint can be replaced by a pyramid joint (figure 4) having a square-shaped cross-section instead of the circular cross-section of a cone. Furthermore, the joint can be composed of different kinds of prongs or flanges (figure 7).

An aggregate according to the invention can be used not only in vibrating feeders and conveyors and vibrating screens but also in other kinds of vibrating devices, such as in vibrating devices and vibrating rollers for compression of masses.

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Claims

1. A vibrating aggregate for vibrating a piece attached thereto, which aggregate includes a shaft (1, 2), an eccentric mass connected thereto eccentrically and transmission arrangements for driving the shaft, whereby a shaft section (2) located at both ends of the shaft and mounted by means of a bearing in the piece to be vibrated is detachably connected to the end of the connecting shaft (1) connecting the shaft sections by a joint (3) transmitting torque moment, **characterized** in that the joint (3) between the shaft section (2) mounted by means of a bearing in the piece to be vibrated and the connecting shaft (1) is rigid and transmits therefore bending moment as well.

2. A vibrating aggregate as claimed in claim 1, **characterized** in that the joint (3) between the shaft section (2) mounted by means of a bearing in the piece to be vibrated and the connecting shaft (1) has counter surfaces in contact with each other.

3. A vibrating aggregate as claimed in claim 2, **characterized** in that the joint (3) between the shaft section (2) mounted by means of a bearing in the piece to be vibrated and the connecting shaft (1) has a recess at the end of one part and a projection (3) that can be inserted into the recess at the end of the other part.

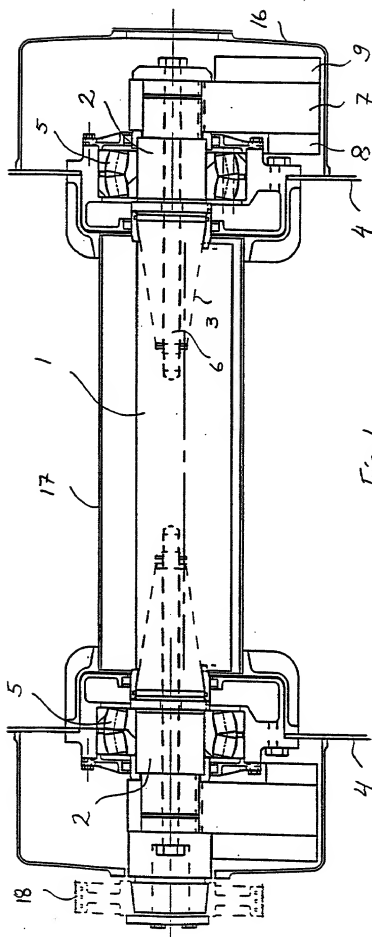
4. A vibrating aggregate as claimed in claim 3, **characterized** in that the recess tapers towards its bottom and the projection (3) tapers towards its point.

5. A vibrating aggregate as claimed in claim 4, **characterized** in that the joint (3) is a cone joint.

6. A vibrating aggregate as claimed in claim 4, **characterized** in that the joint (3) is a pyramid joint.

7. A vibrating aggregate as claimed in any one of claims 1 to 6, **characterized** in that the joint (3) is locked by means of an axial screw (6).

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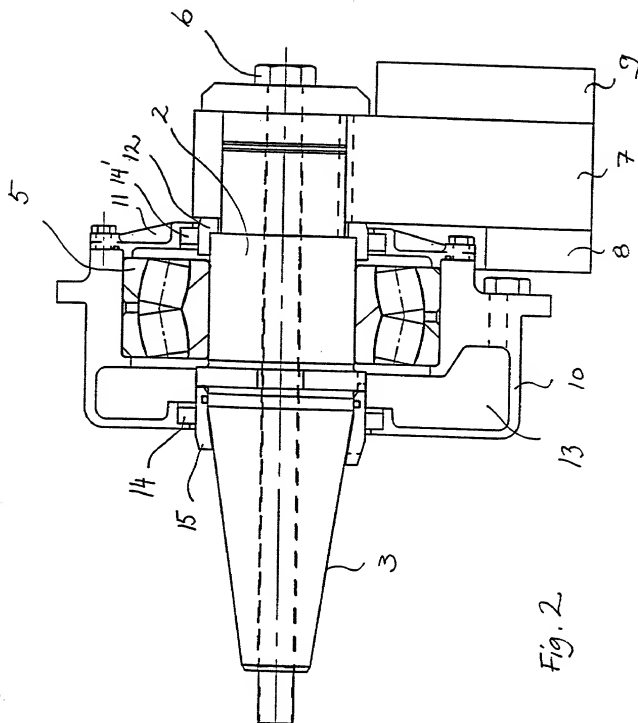


Fig. 2

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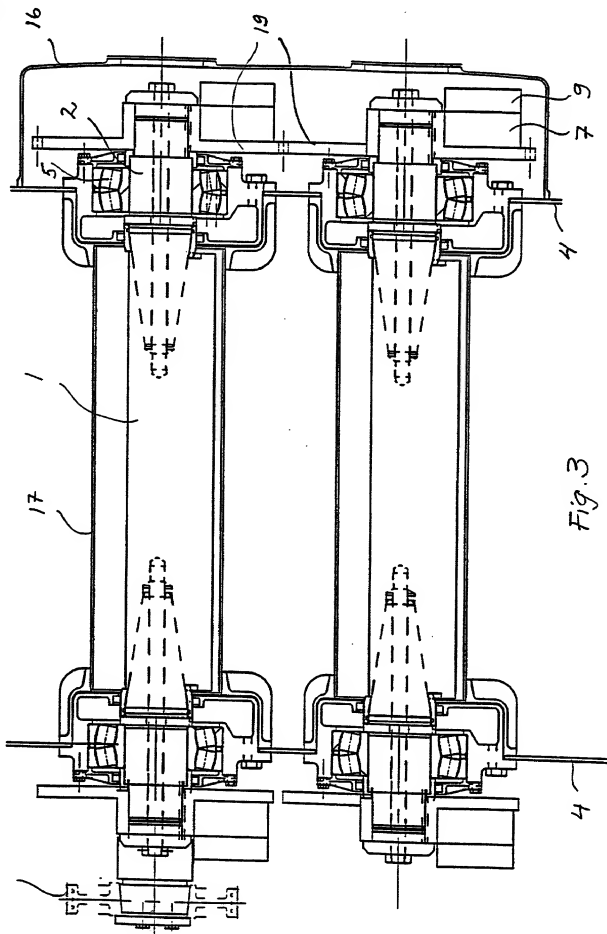


Fig. 3

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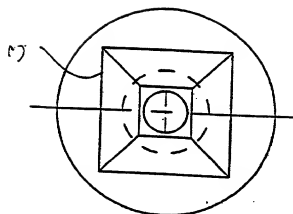


Fig. 4b

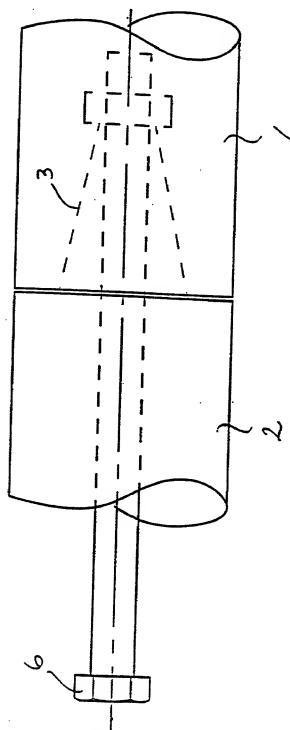
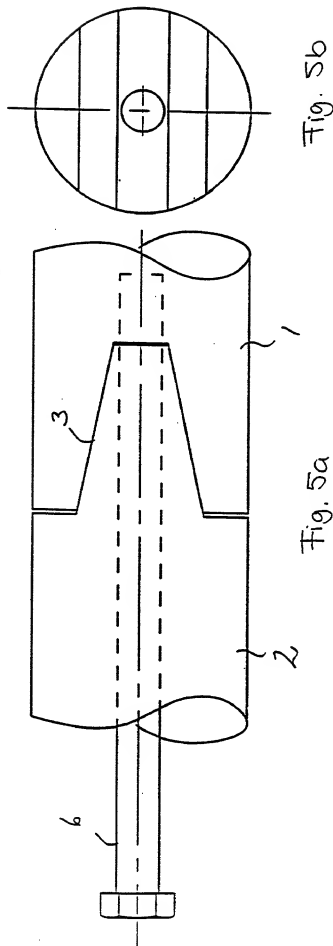


Fig. 4a

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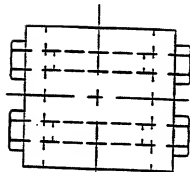


Fig. 6b

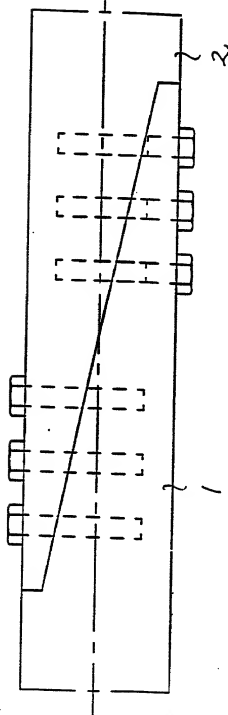


Fig. 6a

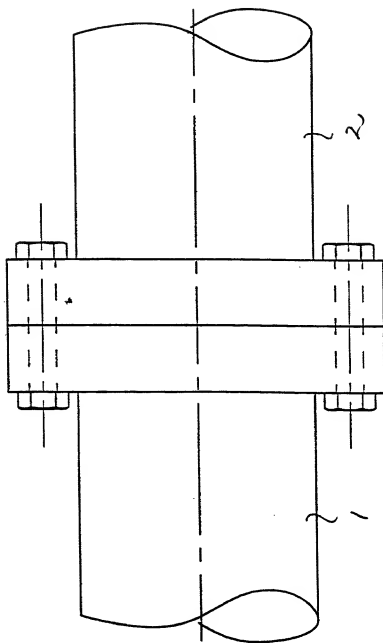


Fig. 7

**COMBINED DECLARATION AND POWER OF ATTORNEY
FOR UTILITY PATENT APPLICATION**

Attorney's Docket No.
023600-227

As a below-named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I BELIEVE I AM THE ORIGINAL, FIRST AND SOLE INVENTOR (if only one name is listed below) OR AN ORIGINAL, FIRST AND JOINT INVENTOR (if more than one name is listed below) OF THE SUBJECT MATTER WHICH IS CLAIMED AND FOR WHICH A PATENT IS SOUGHT ON THE INVENTION ENTITLED:

A VIBRATING AGGREGATE

the specification of which

(check one)

☐

is attached hereto;

☒

was filed on 30 December 1998

as

Application No. PCT/FI98/01033

and was amended on June 21, 2000

(if applicable)

I HAVE REVIEWED AND UNDERSTAND THE CONTENTS OF THE ABOVE-IDENTIFIED SPECIFICATION, INCLUDING THE CLAIMS, AS AMENDED BY ANY AMENDMENT REFERRED TO ABOVE;

I ACKNOWLEDGE THE DUTY TO DISCLOSE TO THE OFFICE ALL INFORMATION KNOWN TO ME TO BE MATERIAL TO PATENTABILITY AS DEFINED IN TITLE 37, CODE OF FEDERAL REGULATIONS, Sec. 1.56 (as amended effective March 16, 1992);

I do not know and do not believe the said invention was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to said application; that said invention was not in public use or on sale in the United States of America more than one year prior to said application; that said invention has not been patented or made the subject of an inventor's certificate issued before the date of said application in any country foreign to the United States of America on any application filed by me or my legal representatives or assigns more than twelve months prior to said application;

I hereby claim foreign priority benefits under Title 35, United States Code Sec. 119 and/or Sec. 365 of any foreign application(s) for patent or inventor's certificate as indicated below and have also identified below any foreign application for patent or inventor's certificate on this invention having a filing date before that of the application(s) on which priority is claimed:

09581997.092000

COMBINED DECLARATION AND POWER OF ATTORNEY

Attorney's Docket No.

023600-227

COUNTRY/INTERNATIONAL	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED
Finland	974667	31 December 1997	YES <u>X</u> NO <u> </u>
			YES <u> </u> NO <u> </u>

I hereby appoint the following attorneys and agent(s) to prosecute said application and to transact all business in the Patent and Trademark Office connected therewith and to file, prosecute and to transact all business in connection with international applications directed to said invention:

William L. Mathis	17,327	R. Danny Huntington	27,903	Gerald F. Swiss	30,113
Robert S. Swecker	19,885	Eric H. Weisblatt	30,505	Michael J. Ure	33,089
Platon N. Mandros	22,123	James W. Peterson	26,057	Charles F. Wieland III	33,096
Benton S. Duffett, Jr.	22,030	Teresa Stanek Rea	30,427	Bruce T. Wieder	33,815
Norman H. Stepno	22,716	Robert E. Krebs	25,885	Todd R. Walters	34,040
Ronald L. Grudziecki	24,970	William C. Rowland	30,888	Ronni S. Jillions	31,979
Frederick G. Michaud, Jr.	26,003	T. Gene Dillahunty	25,423	Harold R. Brown III	35,341
Alan E. Kopecki	25,813	Patrick C. Keane	32,558	Allen R. Baum	36,086
Regis E. Sluiter	26,999	Bruce J. Boggs, Jr.	27,544	Steven M. du Bois	35,023
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Robert G. Mukai	28,531	Peter K. Skiff	31,917	Kenneth B. Leffler	36,075
George A. Hovancec, Jr.	28,223	Richard J. McGrath	29,195	Fred W. Hathaway	32,236
James A. LaBarre	28,632	Matthew L. Schneider	32,814		
E. Joseph Gess	28,510	Michael G. Savage	32,596		



21839

and: none

Address all correspondence to:

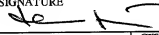
Benton S. Duffett, Jr.
BURNS, DOANE, SWECKER & MATHIS, L.L.P.
P.O. Box 1404
Alexandria, Virginia 22313-1404



21839

Address all telephone calls to: Benton S. Duffett, Jr. at (703) 836-6620.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

FULL NAME OF SOLE OR FIRST INVENTOR Harri Lehtonen		SIGNATURE 	DATE 2000-07-24
RESIDENCE Tampere, Finland		CITIZENSHIP Finland	
POST OFFICE ADDRESS Taivaleentie 14, FIN-33900, Tampere, Finland			